# A Problem with Teflon Insulation

Undercure of teflon coated wiring, a fluropolymer, can lead to harmful corrosion

**Foresite Inc.**

Most of us consider polytetrafluoroethylene (PTFE or Teflon®) as a fairly inert or benign material. This month's case study looks at an instance where this is not the case. The customer was a maker of wire and cable harnesses, using military approved materials, such as MIL-W-22759/33 Teflon wire. The metal in the wires was copper with silver overplate. Connector shells included both plastic (polyphenyl sulfide) and cadmium-plated or nickel-plated versions. Connection to terminals was done by crimping, with no flux and no soldering. When assembly was complete, the connector/wire bundle was placed into a polyethylene bag and heat sealed. A fairly typical operation.

A military customer of these harness assemblies noted corrosion on the connector shells and on the pins of the plastic connectors. A film was noted on the surface of the plastic backshells. Corrosion was noted on gold crimped pins (see photo 1) which had not yet been installed into a connector. The corrosion appeared much more frequently on the white Teflon wires than for colored Teflon wires. The storage environment was 80°F and the bags were heat sealed. No electrical potential existed at any time.

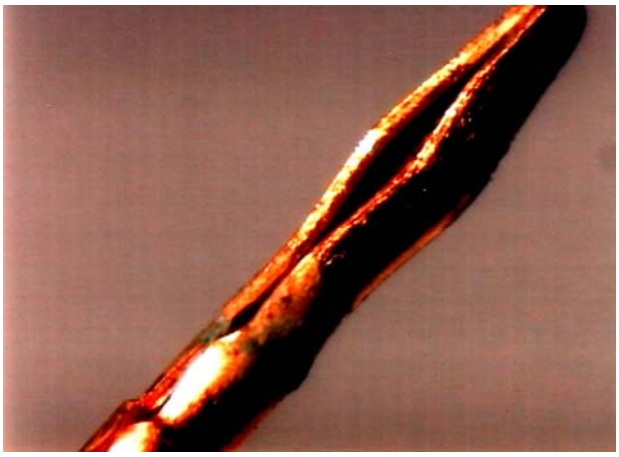


**Photo 1: Corroded Gold Pin**

We examined several of the various kinds of wires. Photos 2 and 3 show the corrosion present on the wire at points under the insulation. The corroded areas had not been previously exposed to the outside environment.

We examined many different samples using ion chromatography. Chart 1 shows the levels found, concentrating on fluoride. We were able to correlate the corrosion to high levels of fluoride. Fluoride levels on corroded backshells often exceeded 50-75 micrograms per square inch. In areas where no corrosion occurred, the fluoride levels were low. Other residues, like chloride and sulfate, were also present, but they did not appear to contribute to this problem. We concluded that there were two sources for the elevated fluoride: the polyethylene bags and undercured Teflon (a fluoropolymer) wire. SEM/EDX analysis also showed the presence of silica on the corroded surfaces. The undercured Teflon outgassed fluoride over time. The silica-based slip agent of the polyethylene bags assisted in the transfer of the fluoride to the corroded parts. It is unknown why the polyethylene bags had such a high level of fluoride.

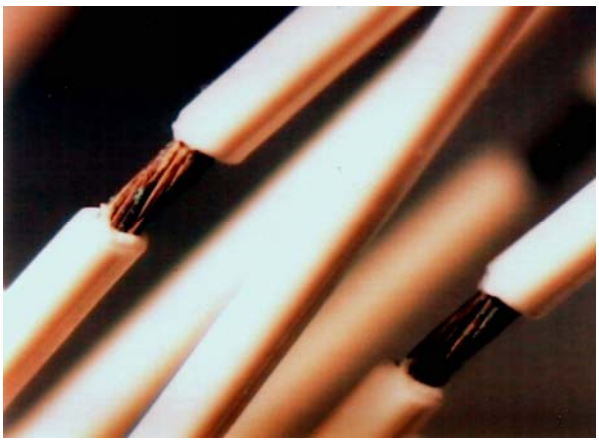
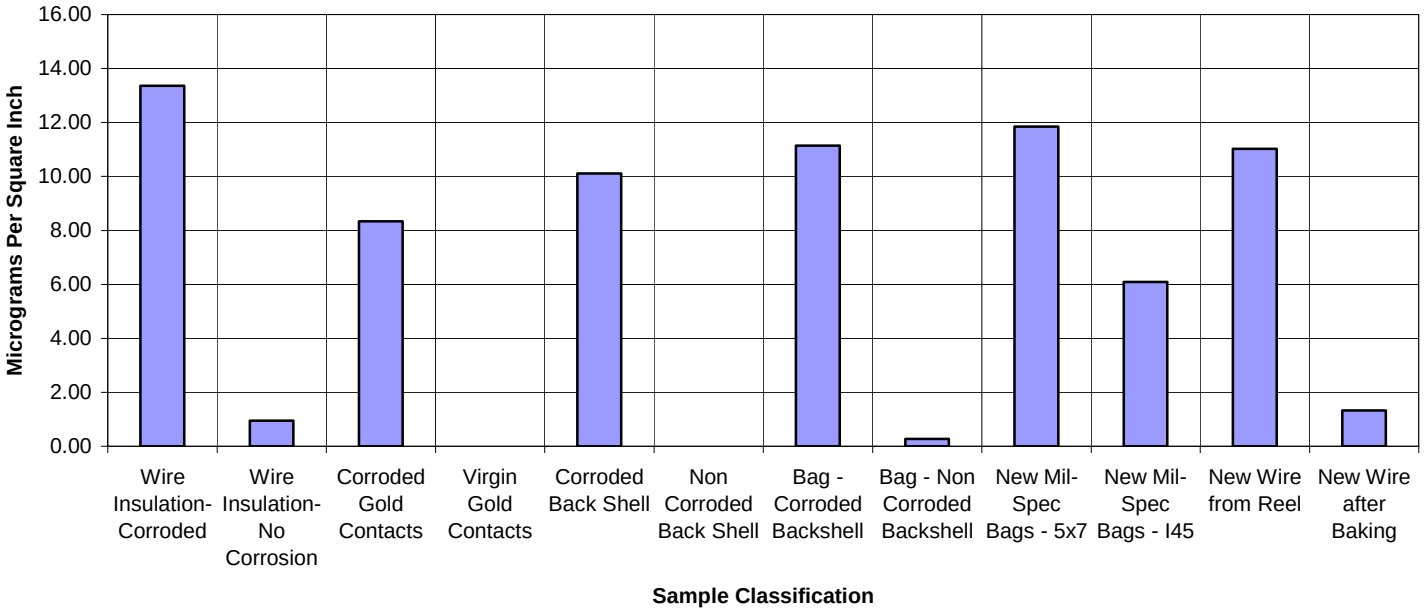


**Photo 2: Corrosion Under Teflon Insulation**

**1982 S. Elizabeth St. • Kokomo, IN 46902 • 765.457.8095 • www.residues.com • ForesiteInfo@residues.com**

**Chart 1: Fluoride Residue Levels**




Fluoride is one of the most electroactive residues known, and is much more corrosive than chloride. The manufacturer began to experiment with baking (1-12 hours @ 200°F) the Teflon wire to complete the cure. The longer bake time dramatically reduced the amount of fluoride. The manufacturer changed polyethylene bag suppliers and the new bags had no detectable level of fluoride. The manufacturer also went to great lengths to investigate the problem, worked with customers to alert them to the potential corrosion, and worked to determine a cure.

A full account of this phenomena, along with efforts for corrective actions, was presented at the International Institute for Terminals and Interconnects (IITIC) conference, by Ms. June Cabourne of Cristek Interconnects, Inc.

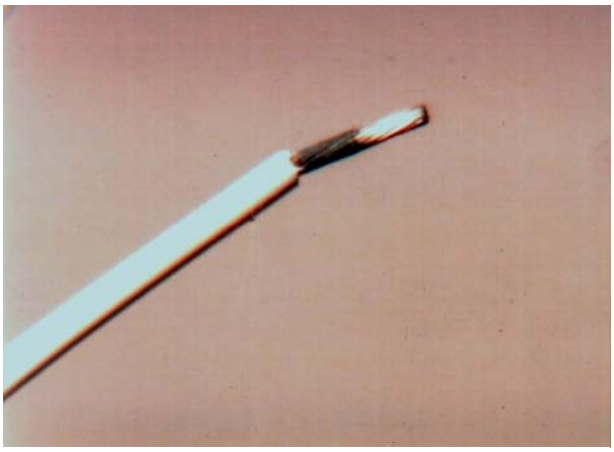


**Photo 3: Corrosion Under Wire**

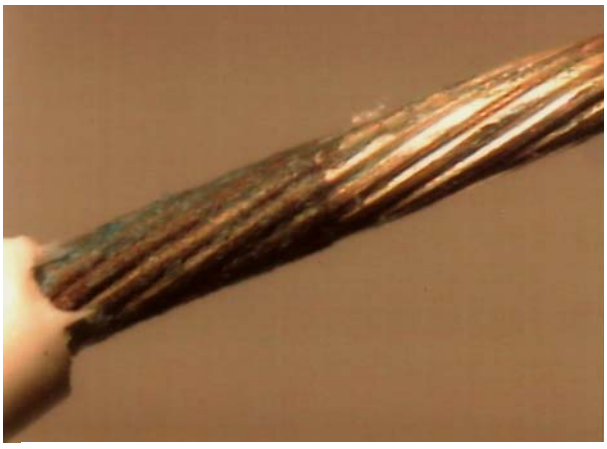


**Photo 2: Closeup of Photo 3**